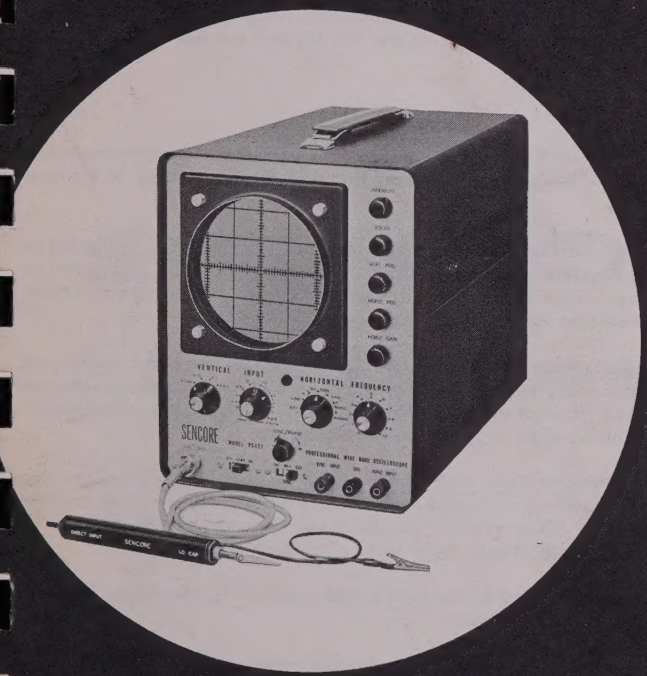
PS 127

5-INCH WIDE BAND OSCILLOSCOPE



SENCORE

SENCORE SERVICE MANUAL

426 S. WESTGATE DRIVE, ADDISON, ILLINOIS

OPERATING INSTRUCTIONS FOR THE SENCORE

PS 127 5 INCH WIDE BAND OSCILLOSCOPE

With the increasing number of color television sets and other electronic devices, the wide band scope has become one of the most important tools to the service technician. It must be capable of a wide response to cover the color burst frequencies, have high sensitivity for low signal levels and must be simple and easy to use, to reduce servicing time. All these features and more are found in the Sencore PS127 5 inch scope. The PS127 combines the wide band response, with high sensitivity and direct reading of peak to peak voltages all in one compact, professional-looking piece of equipment. Some of the features, found on the PS127, are not found on any other service scope on the market today.

Here are some of those features:

Direct Reading of Peak to Peak Voltages: The vertical amplifier input controls are calibrated directly in peak to peak volts, enabling fast and direct reading of all peak to peak waveform voltages.

Completely Wideband: The vertical amplifier is completely wide band, 10 cycles to 6.5 MC, from the most sensitive setting of .05 volts peak to peak per inch down to the less sensitive settings of the controls. No confusing band switching or narrow bands to distort the waveforms and result in erroneous analysis.

Direct and Lo-Cap Probe: Both direct and Lo-Cap probes on the same cable give you maximum versatility. Many of the high impedance circuits, now require the use of a Low capacity probe to prevent upsetting the circuits. With the Sencore probe, you have a direct probe or Lo-Cap at the flick of your wrist.

Direct Measurements of Peak to Peak Voltages in High Voltage Circuits: The Lo-Cap probe, on the PS127, allows you to measure peak to peak voltages of up to 5000 volts peak to peak, directly. Now you can measure the cathode of the damper or the plate of the horizontal output stage, to be sure of proper operation.

Retrace Blanking: Retrace blanking of the horizontal trace is built-in and is effective on all of the horizontal sweep ranges.

Removable Graph Screen: The graph screen can be removed with ease for cleaning, replacement or when not needed, such as when photographing waveforms.

Direct Connection to the CRT Deflection Plates: Direct connection to the CRT deflection plates (through blocking capacitors) is made available on the terminal strip on the rear of the PS127. Intensity modulation (Z axis input) signals may also be applied to the CRT cathode at this same terminal board.

Circuit Breaker: Protects the power transformer and other components of the PS127, if trouble ever occurs in the scope.

SPECIFICATIONS

Frequency Response (3DB limits)

Vertical Amplifier
10 cycles to 6.5MC
RISE TIME .055 microseconds

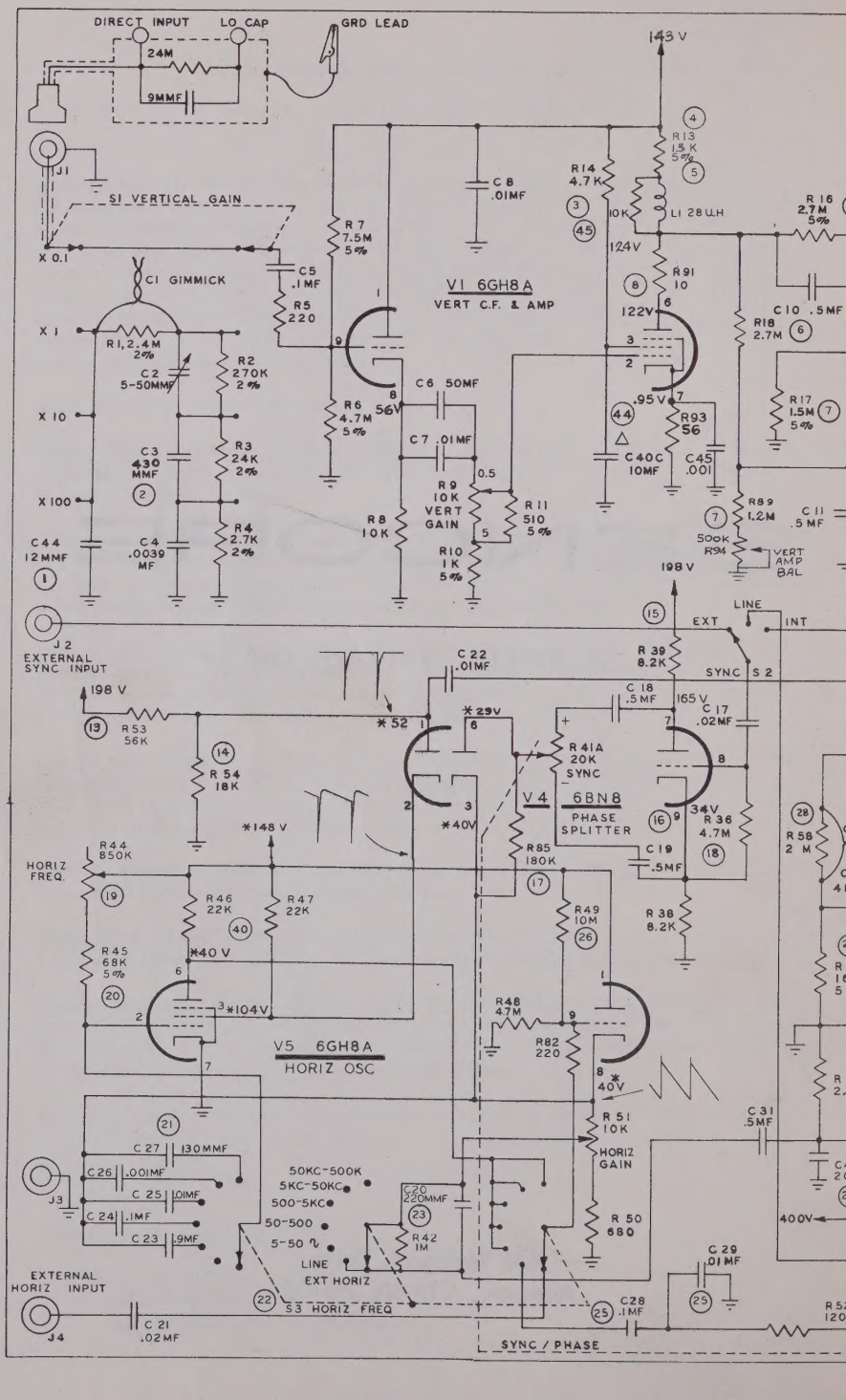
SENCORE

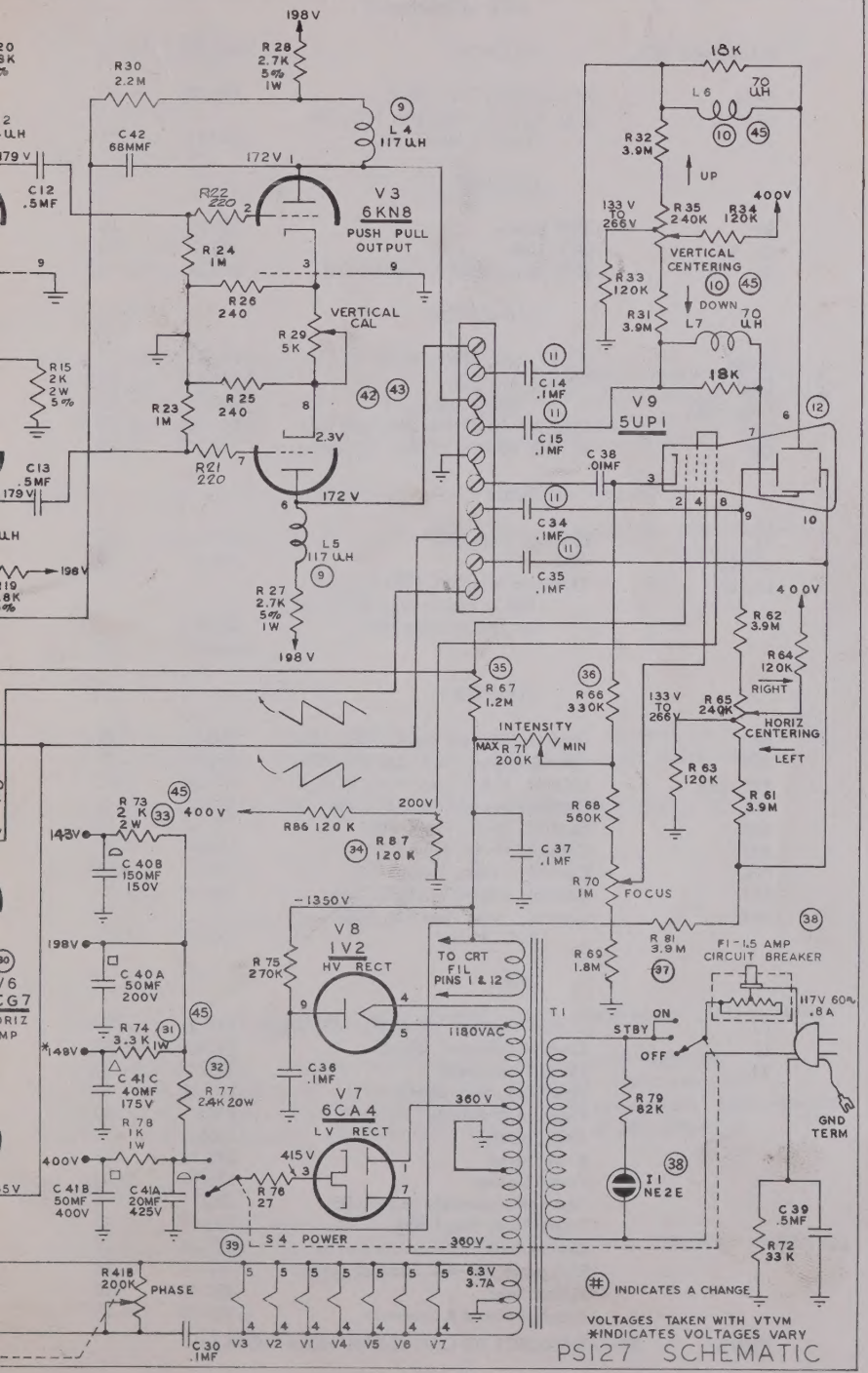
SCHEMATIC AND PARTS LIST

for

PS 127

426 Westgate Drive
Addison, Illinois 60101


DIRECT INPUT
LO CAP
GRD LEAD
24M
9MMF
143 V
J1
S1 VERTICAL GAIN
X 0.1
C1 GIMMICK
X 1
X 10
X 100
R1, 2.4M 2%
C2 5-50MMF
R2 270K 2%
C3 430 MMF
R3 24K 2%
C4 .0039 MF
R4 2.7K 2%
C44 12MMF
R5 220
C5 .1MF
R7 7.5M 5%
C8 .01MF
V1 6GH8A
VERT C.F. & AMP
R6 4.7M 5%
C6 50MF
C7 .01MF
R8 10K
R9 10K VERT GAIN
R10 1K 5%
R11 510 5%
R14 4.7K
10K
L1 28 U.H
R13 1.5K 5%
124V
122V
95V
R91 10
R93 56
C40C 10MF
C45 .001
R16 2.7M 5%
C10 .5MF
R18 2.7M
R17 1.5M 5%
R89 1.2M
C11 .5 MF
500K R94
VERT AMP BAL
198 V
J2
EXTERNAL SYNC INPUT
LINE
EXT
INT
SYNC
S2
R39 8.2K
C22 .01MF
R53 56K
R54 18K
*52
*29V
C18 .5MF
165 V
C17 .02MF
R41A 20K SYNC
V4 6BN8
PHASE SPLITTER
34V
R36 4.7M
*148 V
*40V
R85 180K
C19 .5MF
R38 8.2K
HORIZ FREQ.
R44 850K
R46 22K
R47 22K
R45 68K 5%
R49 10M
R48 4.7M
R82 220
*104V
V5 6GH8A
HORIZ OSC
*40V
R51 10K
HORIZ GAIN
R50 680
C31 .5MF
400V
C27 .130MMF
C26 .001MF
C25 .01MF
C24 .1MF
C23 .9MF
J3
50KC-500K
5KC-50KC
500-5KC
50-500
5-50
LINE
EXT HORIZ
C20 220MMF
R42 1M
EXTERNAL HORIZ INPUT
J4
C21 .02MF
S3 HORIZ FREQ
C28 .1MF
C29 .01MF
SYNC / PHASE



PS127 SCHEMATIC

PS127 PARTS LIST
(Refer to Schematic)

REFERENCE NO.	RESISTORS	Stock No.	Price
Probe	24 meg, 2W, 5%, 10KV	14G223	$4.50
R77	2.8K tapped at 200 ohm 18W, 5% (2.5K in later units)	14G211	.75
	SWITCHES		
S1	2P4P Rotary	25G69	2.50
S2, S4	2P3P Slide	25G64	.75
S3	2P7P Rotary (3P7P in later units)	25G68	2.75
	CAPACITORS		
Probe	9.5 PF, 5%, NPO, 4KV	24G127	.75
C23	.9 uf, 5%, 50V	24G108	1.25
C36, C37	.1 mf, 20%, 1500 volts	24G101	1.40
C40	150, 50, 10 @ 150, 200, 150 volts	24G103	2.75
C41	20, 50, 40 @ 425, 400, 175 volts	24G102	2.95
	COILS		
L1	28Micro H on 10K	46G2	1.25
L2, L3	44Micro H	46G3	.75
L6, L7	117Micro H on 22K (100 Micro H on 18K in later units. 90 Micro H on 22K in latest runs)	46G8 (46A31)	.90
	CONTROLS		
R9	Control, Vertical Input, 10K, 10%	15G33	1.25
R29	Potentiometer, Vert. Cal 5K, 30%	15G10	1.75
R35, R65	Control, V & H Centering, 240K C.T.	15G34	3.25
R41	Control, Sync/Phase 20K-200K, 30%	15G32	4.95
R44	Control, Horiz. Freq, 850K 5%	15G43	2.50
R51	Control, Horiz. Gain, 10K, log	15G37	1.95
R70	Control, Focus, 1 meg, 30%	15G36	1.95
R71	Control, Intensity, 200K, 30%	15G35	1.95
R94	Control, Vert. Amp Bal, 500K P.C. Mount	15A57	1.75
	MISC.		
F1	Circuit Breaker, 1.5 AMP, 1/4" button	44G3	2.00
I1	On-Off Indicator, NE-2E	20G6	.50
T1	Power Transformer	28S24A	24.95
	Line Cord, 3 conductor	27G10	1.50
	Knob, with Pointer	21S3	.20
	Knob, small	21S5	.20
	Knob, large	21G13	.75
	Graph Screen	33G98	1.00
	Test cable assembly (complete)	39G11	9.95
	Thumb Nut, Bezel Mtg	31G11	.25
	Demodulator Probe	39G13	5.75
	Fish paper (for rear terminal board)	12G28	.25
	Rubber Feet	33G74	.15
	Panel, Painted & Screened	C10S109	4.95

#329A (PRICES SUBJECT TO CHANGE WITHOUT NOTICE)

Horizontal Amplifier
10 cycles to over 650 KC

Deflection Sensitivity

Vertical Amplifier
Direct Terminal .017 ± 5% volts RMS/inch
Low Capacity Terminal .17 ± 5% volts RMS/inch

Horizontal Amplifier
At Horizontal Input Jack .6 volts RMS/inch

Input Impedance

At vertical input Jack-2.7 megohms shunted by 20 mmf
Through vertical input cable-direct input jack, 2.7 megohms shunted by 99 mmf
Through vertical input cable-low capacity jack, 27 megohms shunted by 9 mmf
At horizontal input jack 3.2 megohms shunted by approximately 18 mmf
At sync input jack 4.7 megohms shunted by approximately 18 mmf

Horizontal Sweep Generator (Phantastron Type Oscillator Circuit)

Frequency Ranges continuously adjustable with approximately 10% overlap on all ranges

Range 1 - 5 cycles to 50 cycles
Range 2 - 50 cycles to 500 cycles
Range 3 - 500 cycles to 5 KC
Range 4 - 5 KC to 50 KC
Range 5 - 50 KC to 500 KC

TV Horizontal (7875 cycles) and Vert. (30 cycles) are marked on Horizontal Range Control with an "H" and a "V" for fast selection of these ranges.

Synchronization (Selectable and adjustable: Range to approximately 4 mc)

Internal
External
Line Frequency
Sync adjustable between plus and minus

Maximum Input Voltages

Thru Direct INPUT JACK or at Cable INPUT JACK - 1000 volts P/P in presence of 1000 volts DC
Thru LO-CAP JACK - 5000 volts P/P in presence of 1000 volts DC
Thru Horizontal Input Jack - 30 volts P/P in presence of 600 volts DC
Thru Sync Input Jack - approximately 30 volts P/P in presence of 600 volts DC
At Rear Terminal Board - 100 volts P/P in presence of 200 volts DC

Power Requirements

Input Voltages - 105-125 volts AC: 50 to 60 cycles
Power Consumption - Approximately 100 watts: 47 watts in Standby Position

Physical Characteristics

Height - 11 inches
Width - 9 inches
Length - 15-1/2 inches
Weight - 22 pounds

Tube Complement

V1 - 6GH8A Vertical Input Cathode Follower and First Vertical Amplifier
V2 - 6R-HH8/6KN8 Balanced Push-Pull Vertical Driver
V3 - 6R-HH8/6KN8 Balanced Push-Pull Vertical Output Amplifier
V4 - 6BN8 Sync Phase Splitter, Sync Pulse Clipper and Blanking Pulse Clipper
V5 - 6GH8A Horizontal Sweep Oscillator and Horizontal Input Cathode Follower
V6 - 6CG7 Balanced Push-Pull Horizontal Output Amplifier
V7 - 6CA4 Low Voltage Full Wave Rectifier
V8 - 1V2 High Voltage Half Wave Rectifier
V9 - 5UP1 Cathode Ray Tube

CONTROLS ON THE PS127

The PS127 is extremely simple to operate, and a few minutes spent now on learning the position and operation of the panel controls would be beneficial. All of the controls are arranged by function to keep hand motions at a minimum. For example, the CRT beam controls (intensity, focus, and the horizontal and vertical positioning controls) are in a group just to the right of the CRT. The main operating controls (vertical course and fine controls, and the horizontal frequency range and vernier controls) are in a row across the center of the panel. The two vertical controls are on the left side of the panel, and the two horizontal controls are on the right side of the panel. The horizontal gain control is just above the horizontal vernier control, and the sync controls, consisting of a sync selector switch and a polarity reversing potentiometer, are at the center bottom of the panel.

The functions of each of these controls is as follows:

Intensity Control (Controls bias on CRT): Increases intensity (brightness) of the trace on the screen of the Cathode Ray Tube. Maximum intensity is applied when the control is fully clockwise. Generally, the further a pattern is spread out horizontally or vertically, the more the intensity will have to be increased. To extend the useful life of the cathode ray tube, always set the intensity control to the lowest brightness level consistent with satisfactory visibility.

Focus Control (Adjusts voltage on focus electrode in CRT): Adjusts the sharpness (clarity) of the trace. This control will normally need re-adjustment only when the intensity level is changed. Automatic focus is used, which reduces the need for frequent re-adjustment.

Vertical Positioning Control (Changes DC voltage between vertical deflection plates): Adjusts the position of the trace vertically. The trace will move up as the control is rotated clockwise and down as the control is rotated counter-clockwise.

Horizontal Positioning Control (Changes DC voltage between horizontal deflection plates): Adjusts the position of the trace horizontally. The trace will move to the right as the control is rotated clockwise and to the left as the control is rotated counter-clockwise.

Horizontal Gain (Controls signal input to horizontal amplifier): Adjusts the width of the horizontal trace. The trace will expand when the control is rotated clockwise and compress when rotated counter-clockwise.

Horizontal Frequency (Range control): (Second large knob from right side of front panel) This control selects the frequency range of the sweep oscillator. There are five internal sweep ranges (See specifications). In addition, this control connects the Horizontal Input Jack for External Horizontal Input operation and connects the horizontal amplifier to the line frequency (50 or 60 cycles).

Horizontal Frequency (Vernier control): (Large knob at extreme right side of front panel) This control is used in conjunction with the "course" control to obtain the exact horizontal frequency desired to "lock in" a trace.

Vertical Input (Course control): (Large knob at extreme left side of front panel) This control selects the voltage range applied to the vertical amplifier. The full clockwise position is the highest sensitivity (lowest voltage input) and full counter-clockwise is the lowest sensitivity (highest voltage input).

Vertical Input (Fine Control): (Second large knob from left side of front panel) This control is used in conjunction with the course control to obtain the desired height of the trace. To read peak to peak volts, adjust this control for one inch height (one square) and multiply the number at which the knob is pointing by the multiplier obtained from the vertical course control setting above.

Sync Phase (Small knob at lower center of panel): This control selects the amplitude and polarity of the sync voltage applied to the sweep oscillator. It should be adjusted so the pattern just locks into a stationary position. It also controls the phase of the sinusoidal sweep voltage, when the horizontal frequency (course) is set to "Line".

Sync (Slide Switch - located below Sync/Phase control): This switch selects the source of the synchronizing signal for sweep oscillator control. It has an "Internal" sync position, "External" position which connects the sync input to the sync input jack and a "Line" position which provides synchronization from the Power Line.

On-Standby-Off (Slide Switch - located to left of Sync Switch): Applies power to the oscilloscope in the "ON" position. Applies power to Filaments only in "Standby" position. Neon "ON-OFF" indicator should glow in "ON" and "Standby" positions.

OPERATING INSTRUCTIONS

After you have familiarized yourself with the controls and various inputs, the following procedure is recommended for operational simplicity. Place the PS127 in a convenient position and away from any external lighting for easier viewing.

Obtaining a Trace

1. Insert the power cord from the rear of the unit, to a 105-125 volt 50-60 cycle source. The pigtail at the end of the cord may be connected to conduit or any ground connection to reduce pickup in the scope.

2. Push the slide switch to the "Standby" position and rotate all Beam Controls to 1/2 rotation.

3. Rotate the Horizontal Frequency Course Control to "Ext", the VERTICAL INPUT control to X100, the Power Slide Switch to "ON" and the Vertical Input and Horizontal Gain controls completely counter-clockwise.

4. Rotate the Intensity control until a dim dot appears on the screen. Adjust the Focus control until the dot is sharp. Keep intensity at a low level, because a bright dot can burn a hole in the coating on the CRT face. This is especially true if the dot is left in one place on the CRT screen for long periods.

5. Rotate the Horizontal and Vertical Positioning controls until the dot is in the exact center of the screen.

6. Rotate both Horizontal Frequency controls to the range which covers the frequency to be checked.

7. Connect the vertical input cable "direct INPUT" jack to the circuit that is to be observed. NOTE: Insert probe tip into "LO-CAP" jack for high voltage or critical circuits.

8. Rotate both Vertical Input controls clockwise; starting with course control first and then the fine control, until one inch height is obtained. Re-adjust the Horizontal Gain control if necessary.

9. Adjust the Horizontal Frequency controls until the trace stabilizes (does not drift across screen). If the trace cannot be stabilized, adjust the Sync control and Horizontal Frequency (vernier control) until it just stabilizes. Do not apply more sync than necessary to synchronize trace.

10. Read peak to peak volts indicated at the Vertical Input controls. Multiply readings by 10 if measurement is through "Lo-Cap" jack of the cable.

OPERATING NOTES

Always keep trace intensity at a minimum level consistent with satisfactory viewing to extend the life of CRT and reduce the possibility of discoloration or burn on the CRT screen. Slight horizontal non-linearity may be apparent at low frequencies - 5 to 50 cycles. To obtain a more accurate indication, display 6 to 9 cycles of the waveform across the screen and observe the cycles near the center of the screen for linearity. All normal observations should be kept below three inches, for the most accurate reproductions of waveforms.

The horizontal oscillator is free running, but acts somewhat like a triggered sweep in that the pattern never completely goes out of sync; just the timing of the base line changes. This is done to make the PS127 easier to operate than other oscilloscopes.

Scope Applications and Special Uses

The oscilloscope is practically limitless in application. It is a multi-purpose instrument combining features of voltmeters, ammeters, frequency and phase meters, waveform analyzers and many more. Here are a few special applications of the PS127 scope and precautions necessary for correct interpretation and circuit analysis.

Synchroguide Horizontal Oscillator Adjustment: TV receivers employing the RCA type synchroguide circuit require an adjustment on a scope for most stable operation. The ideal waveform is shown in Figure 1. The adjustment is normally made so that the sine wave portion is the same height as the sawtooth portion.

When using the PS127 to make this adjustment, be sure to feed the signal through the Low capacity jack at end of Vertical Input cable. If the adjustment is made through the direct Input jack, the waveform shown can usually be obtained but will change when the scope lead is removed.

Color Servicing: Waveforms present in color servicing are much like those found in black and white TV receivers, except for the circuits that are added over those found in monochrome receivers. Basically, the four new types of waveforms found in color TV receivers are high peak to peak triggering pulses, the color signal before and after removal of the color burst, the detected color signals and the color burst. The color burst is present at the video detector in a color TV receiver as shown in Figure 2.

When viewing the color burst signal from the TV station, it will be apparent that the horizontal gain on the PS127 should be at maximum. If it is difficult to see the nine cycles of color burst signal, it is a good idea to detune the fine tuning on the TV receiver to accentuate the burst. Retuning the fine tuning to normal will reduce the amplitude of the color burst signal, but you will be positive that you are watching the color burst. Also, be sure that a color TV program is on the air. A more positive check can be made with a color bar generator, such as, the Sencore CA122 or CG135. Good reference books are available on color and color trouble-shooting with a scope and bar generator.

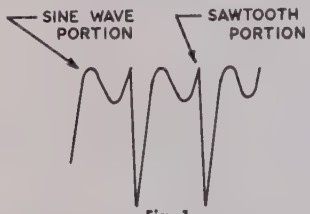


Fig. 1
HORIZONTAL SYNCROGUIDE OSCILLATOR WAVEFORM

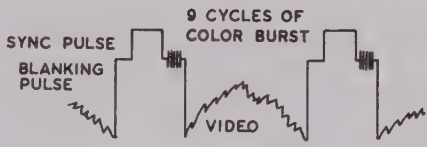


Fig. 2
COLOR BURST SIGNAL

FIG. 3

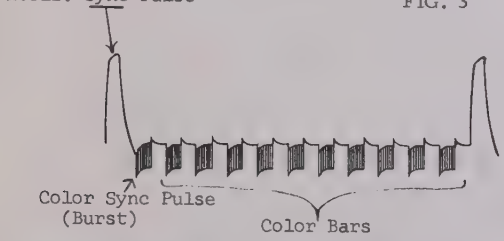


Figure 3. Waveform of the standard color bar pattern as viewed with the PS127. This is the output of the Sencore CA122, CG135, CG10, and CG138 color generators.

Determining Frequency of an Oscillator: Many times, it is desirable to know whether or not an oscillator, such as the horizontal oscillator in a TV receiver, is operating at the correct frequency. An easy method of determining the frequency of operation is to compare the number of waveforms present to a known frequency. See Figure 4.

HORIZONTAL WAVEFORMS INDICATING DOUBLE FREQUENCY

2 VIDEO WAVEFORMS

FIG. 4

For example, to check the horizontal oscillator frequency in a TV receiver, set the PS127 scope to show two horizontal composite video waveforms at the video amplifier and then, without adjusting any controls except vertical gain, view the horizontal oscillator output waveform. If there are two waveforms present, the horizontal oscillator is on frequency as both waveforms repeat at a rate of 15,750 cycles per second. Even though the horizontal frequency in color TV receivers is slightly different, both the sync pulses and horizontal oscillator should operate at the same frequency. If more than two waveforms are present, the oscillator is operating at a higher frequency than 15,750 cycles per second. If only one waveform is present, the oscillator is operating at half frequency. Of course, other numbers than two can be made for the comparison. This merely serves as an example.

TV and FM IF ALIGNMENT

The horizontal input jack provided in the lower section of the PS127 is used for alignment work. Place the Horizontal Frequency course control on EXT and feed the sweep output from the sweep generator to the input jack. Adjust the horizontal gain for satisfactory width. The sync/phase control should be adjusted so that the forward trace and the backward trace are superimposed on each other

LISSAJOUS FIGURES

Lissajous figures are used to determine an unknown frequency, by applying a known sine wave frequency to the horizontal amplifier and the unknown into the vertical amplifier. The frequency ratio between the horizontal and vertical can then be compared. Some typical Lissajous figures are shown in Figure 5.

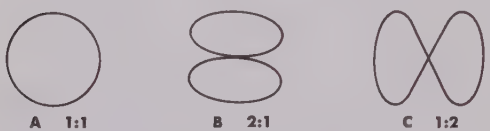


FIG. 5
LISSAJOU FIGURES

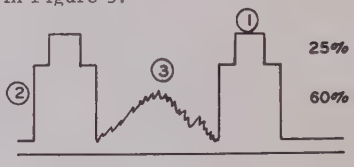


FIG. 6
TYPICAL COMPOSITE SIGNAL

INTERPRETATION OF WAVESHAPES

Black and White TV: For technicians that work primarily in TV, it is recommended that they obtain a TV in good working condition and observe the waveshapes in the various stages. Then inject various troubles and observe what effect the trouble has on the waveshape. Most TV schematics, designed for TV servicing, will have the correct waveshapes printed on them. Some typical TV waveforms are:

1. Composite Signal (See Figure 6)

   a. Sync pulse - starts the retrace and is 25% from the blanking pulse to the top of the blacker than black region.

   b. Blanking pulse - blanks out picture before retrace and usually does not require scope trouble-shooting.

   c. Composite video - varies with picture detail.

2. Sync Pulses (See Figure 7)

NORMAL HORIZONTAL PULSE	CIRCUIT FAULT	HORIZONTAL PULSE DISTORTION	EFFECT ON PICTURE
	NORMAL CIRCUIT		PICTURE NORMAL
	LOSS OF HIGH FREQUENCIES		LOSS OF PICTURE DETAIL
	EXCESSIVE HI FREQUENCY RESPONSE NON-LINEAR PHASE SHIFT		FINE BLK & WHT LINES FOLLOWING A SHARP CHANGE IN PICTURE SHADING
	LOSS OF LOW FREQUENCIES (IN THE RANGE ABOVE 15 OR 20 KC.)		CHANGE IN SHADING OF LARGE PICTURE AREAS; SMEARED PICTURE

FIG. 7

AUDIO

An audio amplifier should be checked for the following:

1. Phase Shift 2. Distortion 3. Overload

Phase Shift: To check for phase shift, apply a sine wave from the audio oscillator to the "Horizontal Input" jack on the PS127 and to the input of the amplifier under test. Apply the output of the amplifier to the vertical input of the scope. See Figure 8. Figure 9 shows the various waveforms which may result.

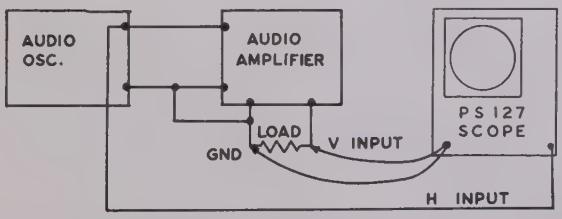


FIG. 8. Connections for Checking Amplitude Distortion and Phase Shift.

FIG. 9
AMPLITUDE DISTORTION AND PHASE SHIFT WAVEFORMS

A. No overload distortion, no phase shift.

B. Overload distortion, no phase shift.

C. Driving into grid current and past cutoff, no phase shift.

D. Phase shift.

E. Phase shift, overload distortion.

F. Phase shift, driving into grid current and past cutoff.

Distortion: Distortion can be best checked by use of a square wave, because detailed information can be obtained by simple analysis. A square wave, of desired frequency, may be obtained from an audio oscillator and wave clipper or from a square wave generator. Usually square wave tests are made at two frequencies, one at 60 cycles and one at a higher frequency, usually between 2000 or 3000 cycles. See Figure 10. Figure 11 shows the various waveforms which may result.

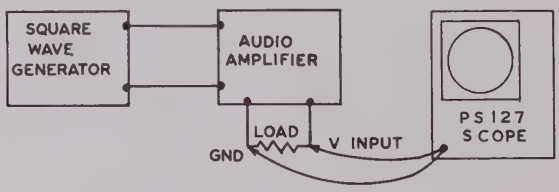


FIG. 10 Connections for Checking Frequency Response.

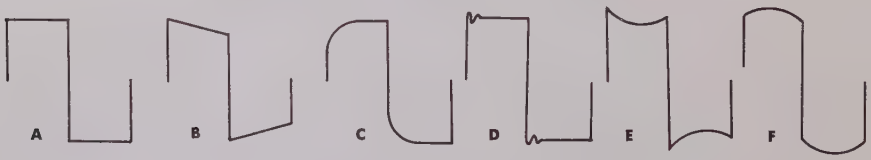


FIG. 11
SQUARE WAVE PATTERNS

A. A typical square wave obtained from a square wave generator.

B. Indicates poor low frequency response.

C. Shows effects of good low frequency response but high frequency cutoff.

D. Indicates excessive high frequency response or even oscillations at high frequencies.

E. Indicates poor transmission of test frequency in relation to other frequencies passed.

F. Shows higher transmission of test frequency than other frequencies passed.

HIGH VOLTAGE CIRCUIT WAVEFORM OBSERVATIONS

When observing high voltage waveforms, such as those in the Vertical or Horizontal output circuits, always use the Lo-Cap jack on the Vertical input cable. Never feed a high voltage pulse through the "direct input" jack. The Vertical Input (course) control should always be in the X100 position. Do not measure pulse voltage higher than 5KV, such as on TV High Voltage Rectifiers. TURN THE TV OFF WHEN MAKING CONNECTIONS TO HIGH VOLTAGE TERMINALS. Keep fingers away from "Lo-Cap" jack when making high voltage measurements to prevent electrical shock.

If these precautions are observed, there will be no difficulty in making high pulse voltage observations. Remember to multiply all oscilloscope peak to peak indications by ten when using the "Lo-Cap" input. A typical horizontal and vertical circuit, showing points where waveform observations are generally made, is shown in Figure 12.

Using PS127 Scope Vertical or Horizontal Amplifiers externally

An output may be taken from the terminals at the rear of the unit from either the Vertical or Horizontal amplifiers (See schematic). To use the vertical amplifier, feed the signal to be amplified into the "direct input" jack of the vertical input cable and take the amplified signal from the first or third terminal at the Right end of the terminal board (as viewed from rear). CAUTION: Set PS127 to "Standby" when making connections to terminal board. The first terminal will produce a signal of the same polarity as that fed into the input cable. If push pull output is desired, signals may be taken from both terminals. The horizontal amplifier may be used in a similar manner. With the horizontal frequency control set at EXT, feed the signal into the Horizontal Input jack and take the amplified signal from the first or third terminal at the left end of terminal board. Vertical or horizontal gain controls should be used to control the amount of gain required.

COIL AND TRANSFORMER CHECKS WITH THE PS127

A shock exciting technique of determining whether a coil or transformer is defective is used by some technicians. This check consists of applying a signal to the coil and noting the effect on a scope. Basically, a good coil with fairly high Q should cause a damped wave effect to show on the scope, as shown in Figure 14A. A defective coil will have less of a damped wave and appear as in Figure 14B.

The PS127 can be used to make these checks very easily. Connect a small condenser (about 100 mm) from the innermost horizontal amplifier terminal connection on the rear of the PS127 (See Figure B). Do NOT disconnect the deflection plate from the amplifier for this test. Connect the coil or transformer to the condenser, and the vertical input to the top of the coil, and the ground to the bottom, as shown in figure 13. The Horizontal Frequency control can be set to any position except in external, and the frequency may be varied to obtain the best looking damped wave or set to the operating frequency or the coil or transformer for a more precise check.

To become acquainted with this type of checking, it is a good idea to connect a number of different types of coils and transformers that are known good, and note the results on the scope. A TV horizontal flyback transformer is a good component to begin with. To check the results of a shorted turn, wrap a piece of solder around the transformer and note the reduction in the ringing.

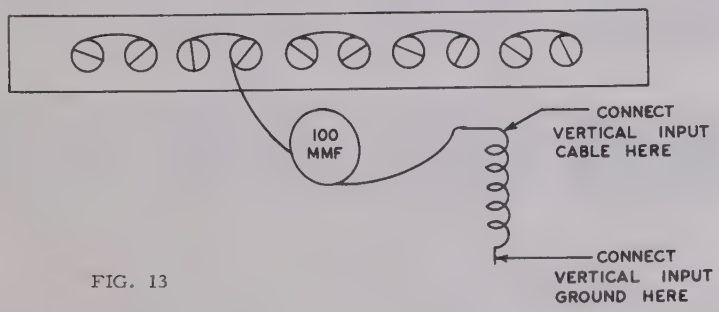
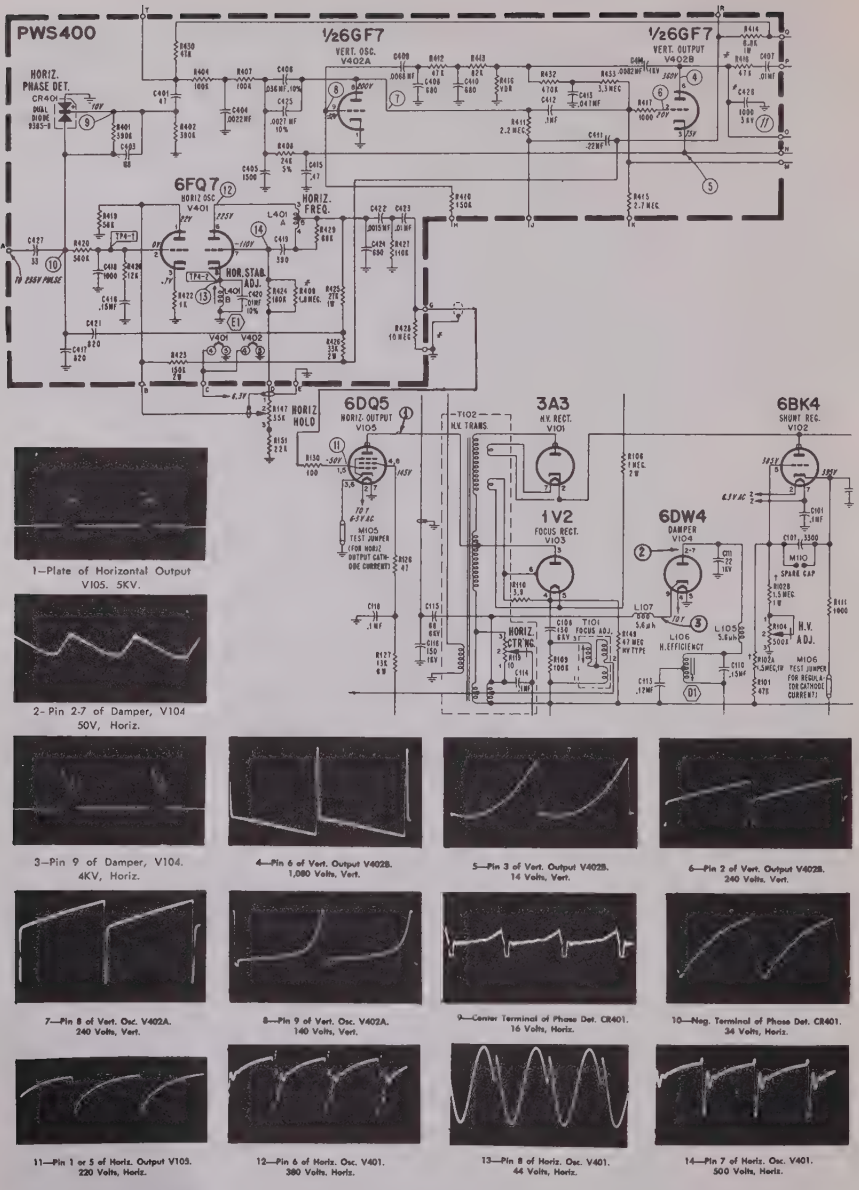


FIG. 13



1—Plate of Horizontal Output V105. 5KV.

2—Pin 2-7 of Damper, V104 50V, Horiz.

3—Pin 9 of Damper, V104. 4KV, Horiz.

4—Pin 6 of Vert. Output V402B. 1,080 Volts, Vert.

5—Pin 3 of Vert. Output V402B. 14 Volts, Vert.

6—Pin 2 of Vert. Output V402B. 240 Volts. Vert.

7—Pin 8 of Vert. Osc. V402A. 240 Volts, Vert.

8—Pin 9 of Vert. Osc. V402A. 140 Volts, Vert.

9—Center Terminal of Phase Det. CR401. 16 Volts, Horiz.

10—Neg. Terminal of Phase Det. CR401. 34 Volts, Horiz.

11—Pin 1 or 5 of Horiz. Output V105. 220 Volts, Horiz.

12—Pin 6 of Horiz. Osc. V401. 380 Volts. Horiz.

13—Pin 8 of Horiz. Osc. V401. 44 Volts, Horiz.

14—Pin 7 of Horiz. Osc. V401. 500 Volts, Horiz.

FIG. 12. Typical TV Horizontal and Vertical Waveforms.

FIG. 14A

FIG. 14B

CALIBRATION AND MAINTENANCE

Calibration: The PS127 peak to peak scale should rarely have to be recalibrated, but with aging tubes and components or the replacement of a tube, it is a good idea to check the unit periodically. To check the calibration of the PS127, the following procedure is recommended.

1. Check a known peak to peak voltage with a known accurate VTVM, which has a direct reading peak to peak scale.
2. Check the same peak to peak voltage with the PS127, adjusting the vertical height to 1" of deflection. The readings on the vertical controls should agree with the voltage measured on the VTVM.

Should your PS127 need recalibration, the following procedure is recommended:

1. Remove the PS127 from the case. (See disassembly instructions.)

2. Apply a known peak to peak voltage to the vertical input. If possible, a 10 volt or 100 volt peak to peak source should be used. For best accuracy, the unit should be calibrated with the vernier control set at 0.5 volts and at frequencies from 400 to 10,000 cycles.

3. If either the high or low end of a range are used, you will note the fine vertical control will rotate 15% down from either 10 or 1. This 15% is a dead spot, such that it still is 10 or 1, so no allowances off the end numerals need be made.

4. With the vertical input controls on the front panel adjusted to correspond with the incoming peak to peak voltage, adjust the sensitivity control on the top of the PS127 chassis, labeled CAL CONTROL, until 1" of vertical deflection is obtained on the screen.

A peak to peak scope calibrator can also be used. For a quick check, the AC line voltage can be applied to the vertical input. It should read about 325 volts peak to peak, if 115 volts AC has been applied. This is obtained by multiplying the RMS value of the line voltage by 2.83. Other voltages can be applied if a variable transformer and accurate AC meter are available.

Input Attenuator Adjustment: The vertical input attenuator on the PS127 has compensation networks to insure more accurate reproduction of the input waveform. These should rarely need adjustment, except when a component or the input amplifier tube has been replaced. They can be adjusted, for the correct compensation without an expensive square wave generator, with these simple steps:

1. Remove the PS127 from its case.

2. Connect the vertical input to the center tap of the HORIZ GAIN control, set the vertical input attenuator switch to X10 position and adjust the HORIZ GAIN control and VERTICAL input vernier control for a 2" long line set at a 45 degree angle.

3. If the trimmer adjustment, on the vertical input switch is incorrect, the line will have a tail on it as shown in figure 15B. Adjust the trimmer, for a straight line, at 45 degrees as shown in figure 15A.

FIG. 15A

FIG. 15B

4. Turn the vertical input switch to the X1 position and check the line. You will have to adjust the HORIZ GAIN control to bring the line back to 2" long. If the "gimmick" is incorrect, the line will again have the tail. Twist, or untwist the gimmick for the line without the tail.

5. Repeat steps 3 and 4, two or three times for best results.

Circuit Breaker: If an overload occurs in the PS127, the circuit breaker, on the rear of the chassis, will break the primary circuit of the power transformer, to protect the circuits of the scope. To reset the breaker, simply push the red button next to the line cord. If the breaker can not be reset, then there is trouble in the PS127 circuits. Normal trouble-shooting procedures should be used to locate the problem.

Balance Control: The vertical balance control in the push pull 6KN8 driver stage, allows for compensation of unbalanced tube sections in this stage. If a new tube is put in the PS127, it should be rebalanced to insure the greatest linearity in the waveform, on the screen. To rebalance this stage, follow these simple steps:

1. Remove the PS127 from its case.

2. Connect a VTVM (zero center scale is best) to pins 1 and 6 of the 6KN8 driver stage. Adjust the VTVM ZERO ADJUST for a center scale reading, and set the range switch to the 10 volt range.

3. Turn the PS127 on, and let it warm up for a few minutes.

4. Adjust the VERT BAL control, for a zero reading, on the VTVM or so there is no difference of potential between the plates of the tube.

If difficulty is encountered with balancing of the tubes, they should be checked in a sensitive checker, such as, the Mighty Mite for grid leakage. An excess of grid leakage will cause an unbalance in the tubes and may cause the balance control to be on end. Vertical balance is under chassis, mounted on the terminal strip, midway between the 6GH8 and 6KN8 driver stage.

REMOVING THE PS127 CHASSIS FROM CASE

To remove the PS127 chassis from its case, remove the three screws at the rear of the unit and the two screws on the bottom front. Slide the chassis forward out of the case while guiding the line cord through opening at rear.

REMOVING GRAPH SCREEN

The graph screen may be removed by removing the four bezel retaining thumb nuts on the front. Remove bezel and graph screen.

CIRCUIT DESCRIPTION

Vertical Amplifier: The input signal is fed through the input cable and jack (J1) to a four position frequency compensated attenuator switch (S1). After the signal level is selected in the attenuator switch it is fed through the triode section of a 6GH8A (V1) which operates as a cathode follower. The cathode follower output signal appears across R9 and R10. R9, the Vertical Gain control selects the required amount of signal to be fed to the pentode section of the 6GH8A where it is amplified. Resistors R10 and R11 set up the proper taper for the vertical gain control. Contact potential bias is developed across R12 to set the proper operating level for the pentode amplifier. The plate load for the pentode amplifier is R13. Screen potential is fed through R14 and the screen is bypassed by C40C. Shunt peaking coil (L1) keeps gain of V1 flat to well over 4MC.

The signal is then fed through C10 to the grid of the first triode section of V2. The second triode section of V2 operates as a grounded grid amplifier, the signal applied to it appearing across the common cathode resistor (R15). R16, R18, R17 and R89 set the proper operating bias for V2. The plate circuits of V2 are compensated for good high frequency response by shunt peaking coils L2 and L3. The 180° out of phase signals are then fed to the control grids of V3 through coupling capacitors C12 and C13. Resistors R21 and R23 prevent parasitic oscillations from occurring. R29 is the vertical CAL POT, and controls degeneration between both triode sections, thereby varying their relative gains. C16 is used to improve frequency response. The plate circuits of V3 are conventional, using well damped combination series and shunt peaking circuits to obtain a flat response to over 4 megacycles. Signals are capacitively coupled to the CRT vertical deflection plates.

A synchronizing signal is taken from V3 and fed to a phase splitter V4, through the sync switch S2. Sync signals of opposite polarity are available at the output of the phase splitter. One diode section of V4 clips the most positive portion of the sync signal and applies it to the sweep oscillator (V5).

Horizontal Sweep Circuits: The horizontal sweep oscillator (V5) operates as a phantastron circuit generating a very linear sawtooth voltage. A sharp negative spike is taken from the screen of V5. It is then clipped in one section of V4 and applied through C22 to the grid of the cathode ray tube for blanking purposes. The sweep frequency of V5 is determined by R44, R45 and C23, C24, C25, C26 and C27. The sawtooth output of V5 is taken from R51, the "Horizontal Gain" control, fed through an RC network (R42 and C20) and coupling capacitor C31 to the control grid of the horizontal amplifier (V6). This RC network reduces oscillator loading effects at high sawtooth sweep frequencies. The amplified sawtooth waveform is fed through C35 to one CRT horizontal deflection plate. It is also fed through C32, to a 12 to 1 resistive divider (R56 and R58) to the second triode section of V6. The amplified output is coupled through C34 to the CRT second horizontal deflection plate. R59 and R60, the plate load resistors for V6, are low in value to improve high frequency amplification in this stage.

Power Supplies and Misc. Circuits: The power supplies are of conventional design using a full wave low voltage rectifier (V7) and a half wave high voltage rectifier (V8).

The output of V7 has several RC filter networks to reduce ripple content and provide isolation between various circuits. The output of V8 is a high negative voltage taken from the plate. It is RC filtered and fed to the cathode ray tube circuits.

Balanced horizontal and vertical centering is obtained by use of center-tapped controls R35 and R65. This provides better astigmatic control of the CRT trade. Resistor R81 in conjunction with Switch S4 is sued to deflect the spot off of the CRT screen in the "Standby" position.

TROUBLE CHART

SYMPTOM	PROBABLE CAUSE	CORRECTIVE MEASURE
Unit completely dead.	Check "OFF Standby-ON" Switch, Circuit Breaker	Switch all the way to right. Push Circuit Breaker into re-set.
	V7 & V8	Replace if necessary.
	R71	Replace if necessary.
	C22	Replace if necessary.
Insufficient intensity or brightness.	V7, V8 or V9	Replace V7, V8, or V9, if necessary.
Insufficient vertical output.	V1, V2 or V3	Replace if necessary.
	R77, C40A, C41C	Replace if necessary.
Unit will not sync.	V4	Replace if necessary.
	C17, C18 and C19	
	R37, R38, R39, R40 & control R41	Replace if necessary.
Sweep Oscillator Instability.	V4, V5	Replace V4 and/or V5.
Insufficient sweep width.	Check setting of R51	Turn R51 fully clockwise.
	V6	Replace V6 if necessary.
	R57 and R78	Check value and replace if defective.
Trace will not center vertically.	Check capacitors C14, C15 for leakage or short	Replace if necessary.
Trace will not center horizontally.	C34 and C35	Replace if necessary.
Poor Low Frequency.	C5, C6	Replace if necessary.
Poor High Frequency Response.	Adjustment of C1, C2	Adjust C1 and C2 for a perfect square wave, using a square wave generator, operating at 15KC.
	L1, L2, L3, L4, L5, L6, L7	Check coils for open; replace if defective.